GUANG ZHOU'S RURAL HOUSING: A GUIDELINES FOR SUSTAINABLE DESIGN

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ABSTRACT

The purpose of this paper is to study the sustainable design guide of rural housing. Through the method of literature research, this paper systematically sorts out the sustainable design guidelines for new rural housing abroad, the sustainable design guidelines for new rural housing in China and the relevant government policies and regulations for rural housing design in Guangzhou. It is found that the study of sustainable design guidelines for rural design in foreign countries is earlier, with rich achievements and experience, which is worth learning from, while the sustainable design guidelines for rural housing in China are in the development stage, while the sustainable design guidelines for housing in Guangzhou are rarely studied, so it can be seen that the study of sustainable design guidelines for housing in Guangzhou is urgent and important.

Keywords: Guangzhou, Rural housing, Sustainable design, Design guide

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INTRODUCTION

Guangzhou is located at the junction of tropics and subtropics. Traditional houses are unique because of their typical subtropical climate adaptability and Guangfu cultural characteristics. However, under the background of globalization and new urbanization, China's rural areas are experiencing a "big change". At present, newly-built rural self-built houses have lost their local characteristics, and "standardized" rural self-built houses have spread freely in rural areas of Guangzhou, and villages are in the same situation, competing to imitate them. Most of these rural self-built houses are copied from urban architectural styles and decorative symbols, which are neither fish nor fowl in the overall context nor regional characteristics, fragmenting the "decoration" of traditional villages, destroying the style of traditional villages and devouring the cultural imprint of Guangzhou. Therefore, a sustainable design guide with regional characteristics is imminent.

Natural and human characteristics of the Guangzhou area

Guangzhou belongs to the Lingnan region, with the Five Ridges to the north and the South China Sea to the south, with a backdrop of mountains and the sea, and a total coastline of 157.1 kilometres, constituting a typical closed and semi-closed geographical environment. Guangzhou is located in the subtropical monsoon maritime climate zone, which is hot in summer and warm in winter, and is mainly characterised by "humidity, heat, wind and rain" (Tang, 2005).

Guangzhou belongs to the hilly area, and its topographical features can be summarised as mountainous hills, plains and water networks, and coastal islands. Guangzhou is backed by mountains and facing the sea, with many terrain types and small slopes, the terrain is high in the north-east and low in the south-west, and the highest peak is on the top of the heaven in Conghua, with an altitude of 1,210 metres. The land types of Guangzhou are mainly divided into low and medium mountains in the northeast, with an elevation of over 500 metres; hilly basins in the centre, with an elevation of between 80 and 500 metres; granite terraces in the centre, with an elevation of between 20 and 80 metres; and coastal alluvial plains and mudflats in the south, with an elevation of less than 20 metres, which are an integral part of the Pearl River Delta (Figure 1).

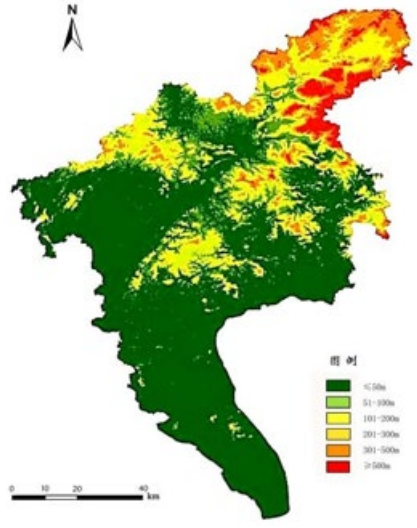

Figure 1 Topographic map of Guangzhou Image
Source: Deng Peiyong (2017)

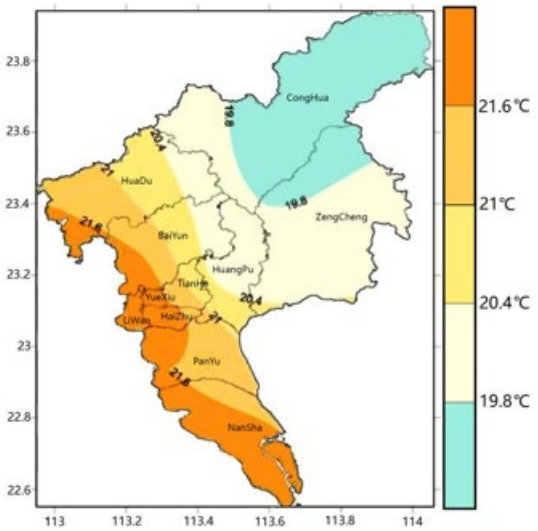

Figure 2 Distribution of annual mean temperature in Guangzhou Image
Source: Guangzhou Autumn Harvest and Autumn Planting Weather Service (2021)

Guangzhou has high temperatures and a long duration of high temperatures. The annual average temperature in Guangzhou is 22.4° C, with July and August being the highest in the year, with an average temperature of 33.2° C. The monthly average temperatures in June-September are over 30° C, and the annual extreme maximum temperatures in each district range from 37.4 to 38.8° C. The annual average temperature in the southern part of Guangzhou is higher than that in the northeastern part of the city. The temperature in the southern part of Guangzhou is higher than that in the northeastern part of the city as a whole. Based on the annual average temperature data in 2021, the annual average temperature distribution map is formed (Figure 2).

Guangzhou has high relative humidity. Due to dense rivers, heavy rainfall, lush forests, surface evaporation and the influence of humid air currents from the marine monsoon, Guangzhou has high relative humidity, which is 79 per cent throughout the year, including 84.5 per cent from April to June (Figure 3).

Guangzhou has abundant rainfall throughout the year, and the seasons are obvious. The average annual rainfall in Guangzhou is more than 1,800 mm, and rainfall is mainly concentrated in April-September, accounting for 80 per cent of the annual rainfall, with the highest rainfall in May-June, when monthly rainfall can reach more than 300 mm, and daily rainfall in summer typhoon storms can reach up to 200 mm, with an average of 7.4 days of stormy weather per year (Figure 4).

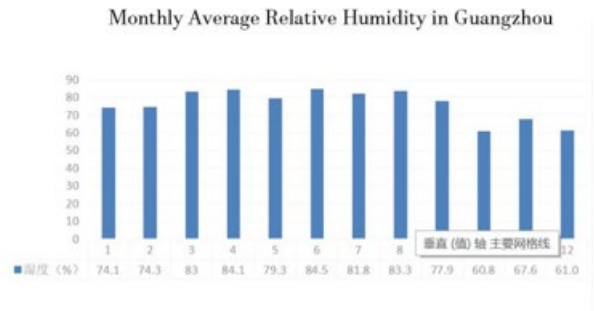

Figure 3 Monthly Average Relative Humidity in Guangzhou Image
Source: Plotted based on the Meteorological Dataset Specific to the Analysis of the Therma l Environment of Buildings in China

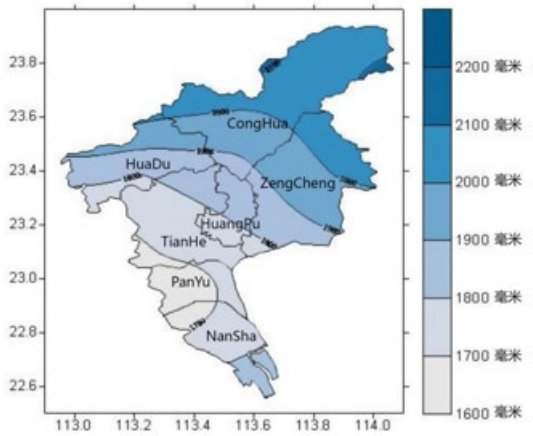

Figure 4 Distribution map of average annual rainfall in Guangzhou Image
Source: Guangzhou Meteorological Information Community Website

Guangzhou is mainly inhabited by Guangfu people, with the tradition of living in clusters, and there are some Hakka villages in Zengcheng, Huadu and other districts. Guangzhou culture is a fusion of the indigenous culture of South Vietnam with the culture of the Central Plains and even Western culture, and it is a regional culture with distinctive characteristics based on the ocean as the background, commerce as the core, and openness, innovation, and compatibility as the driving force (Ji, 2014). Guangzhou has been the political, economic and cultural centre of the Lingnan region since the Qin and Han dynasties, and as the gateway to the country's external exchanges, it enjoys the reputation of "the thousand-year-old commercial capital". Guangzhou people attach importance to local beliefs, especially ancestor worship and the worship of the water god; Guangzhou people attach importance to the concept of feng shui and the harmony between people and the environment; Guangzhou people have the cultural qualities of common people and hedonism, and they are fond of worldly pleasures and interests.

Guangzhou has a large number of overseas Chinese who work hard and love their hometowns. After gaining a successful foothold overseas, they return home to build their hometowns and the country through remittances. Overseas Chinese brought back money and goods as well as advanced Western ideas, construction techniques and materials, which contributed to the blending of East and West in Guangzhou's architecture, art and commodities.

This research aims to analyse the natural climate and human characteristics of the Guangzhou Guangfu area, and sort out the characteristics of excellent domestic and foreign residential design guidelines, so as to guide the formulation of residential design guidelines for the Guangzhou area.

LITERATURE REVIEWS

Guidelines for Sustainable Design of New Rural Residential Buildings Abroad

The sustainability of rural housing in western developed countries was explored earlier, and rich achievements and experiences were achieved in preserving rural characteristics, rural environmental protection and sustainability, and corresponding laws and regulations, control mechanisms, design guidelines, etc. were formed, which can provide us with valuable reference experience.

1. Ireland-a guide to rural housing based on rationality

In 1997, the Irish government issued "Sustainable Development: Strategy for Ireland", which put forward the rural housing strategy for the first time. In 2005, it formed the "Guide to Rural Housing for Sustainable Development in Ireland", with the goal of improving the quality and quality of rural housing design, absorbing local rural traditional elements, emphasizing high efficiency and energy saving, and providing guidance for villagers to build houses. The design guide can be divided into macro, meso and micro levels, from the relationship between architecture and environment, the overall style of architecture to the control of architectural details. And put forward design requirements for new residential buildings: 1) reduce greenhouse gas emissions and environmental pollution of new buildings, 2) reduce artificial lighting, 3) use renewable energy and local building materials as much as possible, 4) reduce energy consumption, reduce excavation, reduce environmental interference, and 5) consider the adaptability of future changes (Meath Countycouncil, 2009).

2. UK-A Guide to Rural Housing Based on Sustainability

British countryside has beautiful natural environment and rich cultural landscape. However, due to the deterioration of the ecological environment, the government issued the Sustainable Housing Act in 2006, and in 2007 and 2010, it issued the Sustainable Housing Pacification Standard (and Technical Guidance) to guide, approve and evaluate new housing. Focus on monitoring nine building factors that affect the environment, including energy and carbon emissions, water consumption, building materials, surface runoff, waste storage, pollution, health and demand, construction management and ecology, and put forward four mandatory indicators: the impact of materials on the environment, surface runoff of construction sites, waste storage space and site waste management. Britain's "Sustainable Housing Pacification Standard (and Technical Guidance)", through the control of scheme design, construction and other stages and the protection of laws and regulations, carries out strict standard quantification, information link and technical guidance on sustainable design elements, so that the sustainability of rural housing in Britain can be effectively implemented and the results are remarkable (Liu, 2016).

3. Germany-residential design guidance based on joint participation The development

Process of German villages can be roughly divided into four stages. 1) In 1936, the Imperial Land Reform Act was promulgated, and it began to manage houses by law. 2) The Land Consolidation Act was promulgated in 1954 to further improve the village infrastructure. 3) In 1976, the Land Consolidation Law was perfected, paying attention to the architectural form

and historical context of villages and protecting the ecological environment. 4) After 1990, integrate the concept of sustainable design, take the protection of ecological environment as the primary task, and attach importance to the continuation of village historical features. German villages have formulated corresponding design guidelines according to the characteristics of their regions, and made unified planning on building materials, colors, shapes, roofs, cornices, tiger windows, door and window styles, so as to maintain local characteristics and sustainability. Another important feature of German design guidelines is the deep participation of villagers, designers and the government. Villagers and designers participate in all aspects of scheme design and housing construction, and communicate and cooperate closely with each other, while the government provides financial support to encourage villagers to actively participate in housing construction (Chang, Zhu & Feng, 2006).

4. Australia-Based on the government-led guide to sustainable housing.

"Your Home" is a guide to sustainable housing construction, which is led by the Australian government and jointly compiled by various professions and departments. It was first promulgated in 2001, and has been continuously updated since then. It is currently the most comprehensive housing construction guide in Australia. The guide is divided into eight parts: design preparation, passive design, materials, energy, water, future housing, case analysis and appendix. Each part has specific suggestions on housing construction and life, as well as relevant required reading materials and expansion information, which are provided to villagers who need to build houses, and some villagers carry out housing design and construction (Bai, 2014).

To sum up, the guidelines for sustainable housing were formulated earlier in developed countries, focusing on ecological design, standards and norms, context continuation, guidance and supervision of the whole process of design and construction, and the joint participation of villagers, professionals and the government. The design guide is mature, comprehensive and operable, which has certain reference value for the formulation of sustainable design guide for residential buildings in China.

Guide to sustainable design of new rural housing in China

Domestic residential design guidelines are not perfect in the development and construction. In 2006, the Series of New Rural Human Settlements and Village Planning compiled by experts organized by the Ministry of Construction was published one after another. This series covers all aspects of rural construction, especially focusing on the protection of historical culture and ecological environment, the management of village renovation and planning construction, infrastructure construction and building disaster prevention, the introduction of new energy, new materials and applicable technologies, and the guidance of economical and harmonious village construction, so that the construction of rural human settlements and the improvement of rural appearance will always follow the correct path of sustainability. In 2008, Shao Xu published the book "Village Architectural Design", which introduced the basic knowledge of village architectural design, architectural construction drawings, structural construction drawings, architectural structure, village residential design, village public architectural design and village ecological architectural design in detail, and attached a variety of village residential design schemes and village solar energy utilization architectural design examples for villagers' reference. In 2013, the Ministry of Agriculture carried out in-depth activities to create the beautiful countryside. In the same year, the Ministry of Housing and Urban-Rural Development once again issued the Measures for the Compilation of Village Renovation Planning (2013) and the Guidelines for the Classification of Village Planning Land (2014) and other related specifications.

In recent years, the compilation of rural housing guides in various provinces (cities) has been gradually carried out by the government, universities and enterprises in the form of atlas, specification and competition. For example, in 2015, Cangnan County, Zhejiang Province

invited China Academy of Fine Arts and Tongji University Architectural Design Institute to tailor 20 sets of beautiful residential design schemes for Cangnan County, Zhejiang Province, providing design schemes for local beautiful countryside construction. In 2016, the Shaanxi Provincial Department of Housing and Urban-Rural Development collected 190 new rural residential construction plans from various survey and design units and designers in the province. According to the architectural policy of "applicability, economy, green and beauty", it met the requirements of rural life and production, and selected the best ones from the aspects of perfect function, environmental conservation, moderate scale, reasonable cost, easy implementation and being conducive to showing new rural features. In 2019, Huazhong University of Science and Technology Press published the Standard Atlas of Rural Housing in Wuhan (Standard Atlas of Rural Dwellings) and the Standard Atlas of Rural Housing in Wuhan (Atlas of Environmental Renovation in Front of Rural Houses), providing construction guidance for the construction of new countryside in Wuhan, improving the overall rural landscape, saving land resources, highlighting local architectural features and ecological landscape.

In Lingnan area, In 2018, the Guangdong Provincial Department of Housing and Urban-Rural Development organised a province-wide collection of cases of excellent agricultural housing design schemes, and after expert evaluation, a total of 38 excellent schemes were shortlisted to organise the Guangdong Provincial Architectural Design and Research Institute to compile the "Lingnan New Style - Guangdong Provincial Agricultural Housing Design Schemes Atlas (Volume 1)" for the design of agricultural housing in the province to be used as a choice and reference.in 2021, the Housing and Urban-Rural Development Department of Guangdong Province issued "Green Building Design Inheriting Lingnan Old Building Culture", which emphasized the key points of green technology, cultural inheritance and sustainable construction concept, and introduced relevant cases in the form of atlas, photos and analysis maps, providing guidance for Lingnan regional residential design.

At present, scholars actively carry out research and discussion on the guide to sustainable design of rural housing, and put forward their own views and schemes. In 2011, Xu Ya and Yang Haozhong put forward the design requirements of sustainable new rural architecture in their paper "Research on Sustainable Building Mode in New Countryside-Residential Design in Guanzhong Area": 1) Maximize the use of renewable resources, especially solar energy and wind energy; 2) By increasing the wall area, the heat loss is minimized; 3) Design a high thermal insulation mass building instead of a light building; 4) Use greening to improve the microclimate around the building; 5) Avoid buildings with too long plane depth. If it is inevitable, it is recommended to use atrium; 6) Use atrium to promote natural ventilation; 7) Improve the thermal insulation level of buildings; 8) Use natural lighting, ventilation and refrigeration; 9) Reuse buildings and reduce the construction of new buildings. In 2012, Jin Guanqiang put forward the first guiding strategy of rural housing self-construction in the article "Research on Guiding Strategy of Rural Housing Self-construction under Urban and Rural Planning": the policy and planning control level, including public infrastructure, new building materials and clean energy, land guidance for residential self-construction, self-construction combination mode and other aspects; Strategy 2: Architectural level, including single function and space guidance, architectural form guidance, architectural technology guidance and building materials guidance. In 2016, Liu Bingjing's master thesis "Study on the Compilation of Rural Housing Construction Guidelines in Chenxi" proposed to compile design guidelines from five aspects: architecture and environment, function and plane layout, application of traditional elements, sustainable housing design and comprehensive design demonstration. In 2020, Wang Chen's thesis "Ecological Strategy and Application Research on the Suitability of Traditional Dwellings in Central Jiangxi" put forward four aspects of residential design guidelines, namely, "the overall design conforming to nature, the optimization and renewal of

single building, the optimization and renewal of construction system, and the supplementary utilization of energy technology".

For Lingnan area, Wei Bin put forward a guide for sustainable design of Lingnan residential buildings around group planning and layout, space form construction (shape selection, ground floor overhead, making good use of patio, building cold alley) and detail treatment (double insulation and full shading) in his master's thesis "Research on Modern Application Design of Lingnan Traditional Residential Buildings".

Relevant government policies and regulations on rural residential design in Guangzhou

At present, there are no clear guidelines or guidelines for sustainable residential design in Guangzhou, but the government has made regulations on the application process, building base, building area, building height and architectural style of rural residential construction. In October 2001, the Guangzhou Municipal People's Government issued the Regulations on the Administration of Rural Villagers' Residential Land in Guangzhou. Article 5 stipulates that rural villagers should try their best to use the original homestead and Kugaji in the village and strictly control the use of cultivated land. Article 8 stipulates that the construction of residential homestead in rural areas: below 80 square meters in plain areas; The hilly area is less than 120 square meters; The mountainous area is less than 150 square meters. In July, 2020, the Guangzhou Municipal People's Government issued the Implementation Opinions on Strengthening the Management of Rural Residential Construction, which clarified the construction standards for new rural residential buildings. The newly approved homestead was controlled within 80 square meters, the construction area was controlled within 280 square meters, the building floor was no more than 3 floors, the height of some buildings on the 3 floors was ≤11 meters, and the building height of stairs and functional rooms was ≤14 meters. For the demolition or reconstruction of villagers' original homestead houses, the construction can be carried out according to the control requirements of total area ≤280 square meters and height limit ≤14 meters. Conform to the building design code, and raise or lower the indoor platform by no more than 0.45m.. In April, 2023, Guangzhou Municipal Bureau of Planning and Natural Resources issued the Letter of Guangzhou Municipal Bureau of Planning and Natural Resources on Printing and Sending a Series of Guidelines for Planning Land for "High-quality Development Project of Wancun Village in Baixian County", which clarified the construction management requirements and procedures of villagers' houses in different regions, the conditions for villagers to apply for houses, the overall process, procedures, material preparation and matters needing attention of villagers' houses. It also stipulates the height of new residential buildings, the area of building base and the total building area, and stipulates the standards of residential building spacing, orientation and facade; Put forward the guiding points for the villagers' building style, emphasize the Lingnan cultural characteristics, and reflect the economic use, energy saving and beauty.

RESEARCH METHODOLOGY

1. Literature research method

Lay the theoretical and data foundation for this study through literature collation and induction. Lay a solid foundation for the information and data of this research through collecting historical maps, local records and related research books and research papers, conducting theoretical induction and qualitative analysis, establishing the guiding ideology and research direction of this paper, using quantitative analysis methods and statistical classification and induction methods for the geographic environment and natural climate data.

2. Case Analysis Method

We mainly analyze the successful cases of regional design, sort out and analyze their research approaches and design methods, summarize the core points for reference, and summarize their creation principles and laws as reference and reference for this study. The research cases mainly

include the design of the relocated farmhouse in Dongziguan, Fuyang, Hangzhou, Shenzhen Vanke the Fifth Garden, Lingnan Xintiandi, Jiangmen Yuanshang Xitang Resort Complexity, Suzhou Museum, etc.

CONCLUSION& DISCUSSION

The main characteristics of Guangzhou's rural natural environment are summarised as follows: varied topography, abundant water flow, hot temperatures, long sunshine hours, high sunlight radiation, high relative humidity of the air, heavy rainfall, pronounced monsoon, moderate winds and strong typhoons. In order to adapt to the topography and climatic characteristics of Guangzhou, the buildings in Guangzhou pay special attention to sunshade, heat insulation, ventilation, drainage, moisture-proof and typhoon proof.

Because of the influence of marine culture and commercial culture, Guangzhou people have formed a humanistic character of "emphasis on business, openness, innovation and tolerance"; Guangzhou has strong folk beliefs and rich folklore activities. Guangzhou is adjacent to the sea to the south and has been a trading port since ancient times, with a well-developed commodity economy and a large number of overseas Chinese who have made significant contributions. The exchange and collision of Chinese and Western cultures in Guangzhou have always given birth to the unique regional cultural characteristics of Guangzhou, which is a combination of Chinese and Western cultures.

Overseas country house design strategies are rich and varied. Ireland has adopted a regional design guideline for country houses, which sets out regional design requirements for both the overall appearance of the house and the details of the building. The UK adopts the concept of sustainable design, and strictly monitors the energy consumption, carbon emission and pollution of buildings. Germany adopts the guiding principle of joint participation, allowing villagers, designers and the government to participate in depth. Australia adopts a government-led strategy to guide the whole process of designing and constructing country houses.

Some theoretical and practical explorations have been carried out in China on the design of beautiful village houses. Books have been published on the architectural design of villages and towns, the Atlas of Rural Characteristic Residence Designs in Shanxi Province , the Standard Atlas for Rural Housing Construction in Wuhan (Standard Atlas for Rural Residences) (Figure. 5), the New Style of Lingnan - Atlas of Agricultural Housing Design Schemes in Guangdong Province (Volume 1) (Figure. 6), and the Green Architectural Design of Inheriting the Lingnan Architecture and Culture , with emphasis on green technology, cultural heritage and the concept of sustainability.

Figure 5: Wuhan Architectural Design Cases
Source: Zhao kui (2019)

Figure 6： Lingnan Architectural Design Cases

Source: Guangdong Provincial Department of Housing and Urban-Rural Development (2023)

To sum up, the rural residential sustainable design guide started earlier in foreign countries, with rich achievements and experience, which is worth learning from. However, the domestic residential design guidelines are in the construction period, and the laws, regulations and policy guidelines are not perfect, and the participation and operability of the whole people are not high. Although some provinces and cities have some guides and atlas, due to the lack of rural funds, the lack of rural house design talents, the lack of farmers' cultural self-confidence and the lack of policy support, the design guidelines are difficult to be effectively implemented in the current rural areas, with little effect. As far as Guangfu area in Guangzhou is concerned, the guide for sustainable design of rural housing has not been put forward systematically, so it is necessary and urgent to study the guide for sustainable design of rural housing in Guangzhou area.

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